**BEFORE THE**
**PUBLIC SERVICE COMMISSION OF**
**SOUTH CAROLINA**
**DOCKET NO. 2018-3-E**

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| In the Matter of<br>Annual Review of Base Rates<br>for Fuel Costs for<br>Duke Energy Carolinas, LLC | )<br>)<br>)<br>) | **DIRECT TESTIMONY OF**<br>**STEVEN D. CAPPS FOR**<br>**DUKE ENERGY CAROLINAS, LLC** |

**Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

A. My name is Steven D. Capps and my business address is 526 South Church Street, Charlotte, North Carolina.

**Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

A. I am Senior Vice President of Nuclear Corporate for Duke Energy Corporation ("Duke Energy" or "Duke") with direct executive accountability for Duke Energy's nuclear corporate functions, including nuclear corporate engineering, nuclear major projects, corporate governance and operation support and organizational effectiveness.

**Q. WHAT ARE YOUR RESPONSIBILITIES AS SENIOR VICE PRESIDENT OF NUCLEAR CORPORATE?**

A. As Senior Vice President of Nuclear Corporate, I am responsible for providing executive oversight of nuclear corporate support functions, ensuring these functions support the safe and reliable operation of Duke Energy's six operating nuclear stations. As a member of the senior leadership of Duke's Nuclear Generation Department, I am also involved in the operations of Duke's six operating nuclear stations, including Duke Energy Carolinas, LLC's ("DEC" or the "Company") Catawba Nuclear Station ("Catawba") in York County, South Carolina; McGuire Nuclear Station ("McGuire") in Mecklenburg County, North Carolina; and Oconee Nuclear Station ("Oconee") in Oconee County, South Carolina.

**Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.**

A. I have more than 31 years of experience in the nuclear field. I joined Duke Energy in 1987 as a field engineer at Oconee. During my time at Oconee, I served in a variety of leadership positions at the station, including Senior Reactor Operator, Shift Technical Advisor, and Mechanical and Civil Engineering Manager. In 2008, I transitioned to McGuire as the Engineering Manager. I later became plant manager and was named Vice President of McGuire in 2012. I assumed my current position in December 2017. I earned a B.S. in Mechanical Engineering from Clemson University.

**Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?**

A. The purpose of my testimony is to describe and discuss the performance of DEC's nuclear fleet during the period of June 1, 2017 through May 31, 2018 (the "review period").

**Q. YOUR TESTIMONY INCLUDES THREE EXHIBITS. WERE THESE EXHIBITS PREPARED BY YOU OR AT YOUR DIRECTION AND UNDER YOUR SUPERVISION?**

A. Yes. These exhibits were prepared at my direction and under my supervision.

**Q. PLEASE PROVIDE A DESCRIPTION OF THE EXHIBITS.**

A. The exhibits and descriptions are as follows:

Capps Exhibit 1 - Calculation of the nuclear capacity factor for the review period pursuant to S.C. Code § 58-27-865

Capps Exhibit 2 - Nuclear outage data for the review period

Capps Exhibit 3 - Nuclear outage data through the billing period [1]

**Q. PLEASE DESCRIBE DEC'S NUCLEAR GENERATION PORTFOLIO.**

A. The Company's nuclear generation portfolio consists of approximately 5,389[2] megawatts ("MWs") of generating capacity, made up as follows:

Oconee - 2,554 MWs

McGuire - 2,316 MWs

Catawba - 519 MWs[3]

**Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF DEC'S NUCLEAR GENERATION ASSETS.**

A. DEC's nuclear fleet consists of three generating stations and a total of seven units. Oconee began commercial operation in 1973 and was the first nuclear station designed, built, and operated by DEC. It has the distinction of being the second nuclear station in the country to have its license, originally issued for 40 years, renewed for up to an additional 20 years by the NRC. The license renewal, which was obtained in 2000, extends operations to 2033, 2033, and 2034 for Oconee Units 1, 2, and 3 respectively.

McGuire began commercial operation in 1981 and Catawba began commercial operation in 1985. In 2003, the NRC renewed the licenses for McGuire and Catawba for up to an additional 20 years each. This renewal extends operations until 2041 for McGuire Unit 1, and 2043 for McGuire Unit 2 and Catawba Units 1 and 2. The Company jointly owns Catawba with North Carolina Municipal Power

[1] This data is provided in confidential and publicly redacted versions for security purposes.
[2] Based on Net Maximum Dependable Capacity as of January 1, 2018.
[3] Reflects DEC's 19.2 percent ownership of Catawba Nuclear Station.

Agency Number One, North Carolina Electric Membership Corporation, and Piedmont Municipal Power Agency.

**Q. WHAT ARE DEC'S OBJECTIVES IN THE OPERATION OF ITS NUCLEAR GENERATION ASSETS?**

A. The primary objective of DEC's nuclear generation department is to safely provide reliable and cost-effective electricity to DEC's Carolinas customers. The Company achieves this objective by focusing on a number of key areas. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with detailed procedures. The Company maintains station equipment and systems reliably, and ensures timely implementation of work plans and projects that enhance the performance of systems, equipment, and personnel. Station refueling and maintenance outages are conducted through the execution of well-planned, well-executed, and high quality work activities, which effectively ready the plant for operation until the next planned outage.

**Q. PLEASE DISCUSS THE PERFORMANCE OF DEC'S NUCLEAR FLEET DURING THE REVIEW PERIOD.**

A. The Company operated its nuclear stations in a reasonable and prudent manner during the review period, providing 61 percent of the total energy generated by DEC. The seven nuclear units operated at an actual system average capacity factor of 96.74 percent for the review period which included four refueling outages.

As shown on Capps Exhibit 1, DEC achieved a net nuclear capacity factor, excluding reasonable outage time, of 101.53 percent for the review period. This

capacity factor is above the 92.5 percent set forth in S.C. Code § 58-27-865(F), which states in pertinent part:

> There shall be a rebuttable presumption that an electrical utility made every reasonable effort to minimize cost associated with the operation of its nuclear generation facility or system, as applicable, if the utility achieved a net capacity factor of ninety-two and one-half percent or higher during the period under review. The calculation of the net capacity factor shall exclude reasonable outage time associated with reasonable refueling, reasonable maintenance, reasonable repair, and reasonable equipment replacement outages; the reasonable reduced power generation experienced by nuclear units as they approach a refueling outage; the reasonable reduced power generation experienced by nuclear units associated with bringing a unit back to full power after an outage....

The performance results discussed above support DEC's continued commitment for achieving high performance without compromising safety and reliability.

**Q. HOW DOES DEC'S NUCLEAR FLEET COMPARE TO INDUSTRY AVERAGES?**

A. The Company's nuclear fleet has a history of top quartile performance. Industry data for 2017 ranked Duke Energy's nuclear fleet favorably when compared to the seven other large domestic nuclear fleets using Key Performance Indicators ("KPIs") in the areas of personal safety, radiological dose, manual and automatic shutdowns, capacity factor, forced loss rate, industry performance index, and total operating cost. The Duke fleet ranked in first place in the overall composite ranking of the 7 industry key performance metrics, and placed in first position in total operating cost and second place in capacity factor. On a larger industry basis using data for 2017 from Electric Utility Cost Group, Catawba, McGuire, and Oconee all achieved top quartile total cost performance during 2017. Oconee and Catawba

ranked in 5th and 6th place, and McGuire placed in 12th position among the 60 U.S. operating plants. Industry benchmarking efforts and industry excellence initiatives are the principal technique used by the Company to ensure best practices. These efforts further ensure overall prudence, safety, and reliability of DEC's nuclear units.

Additionally, for 18 consecutive years DEC's nuclear plants have surpassed a 90 percent annual capacity factor threshold. As a result of this strong operational performance, the Company has produced approximately 36 million MWHs of additional generation, which is equivalent to an additional 7.5 months of output (based on DEC's average annual generation for the same 18-year period). These performance results support DEC's continued commitment to achieving high performance without compromising safety and reliability.

**Q. WHAT IMPACTS A UNIT'S AVAILABILITY AND WHAT IS DEC'S PHILOSOPHY FOR SCHEDULING REFUELING AND MAINTENANCE OUTAGES?**

A. In general, refueling requirements, maintenance requirements, prudent maintenance practices, and NRC operating requirements impact the availability of DEC's nuclear system. Prior to a planned outage, DEC develops a detailed schedule for the outage and for major tasks to be performed including sub-schedules for particular activities.

The Company's scheduling philosophy is to plan for a best possible outcome for each outage activity within the outage plan. For example, if the "best ever" time an outage task was performed is 10 days, then 10 days or less becomes the goal for that task in each subsequent outage. Those individual goals are incorporated into an overall outage schedule. The Company aggressively works to meet, and measures

itself against, that schedule. Further, to minimize potential impacts to outage schedules, "discovery activities" (walk-downs, inspections, etc.) are scheduled at the earliest opportunities so that any maintenance or repairs identified through those activities can be promptly incorporated into the outage plan.

As noted, the schedule is utilized for measuring outage planning and execution, and driving continuous improvement efforts. However, in order to provide reasonable, rather than best ever, total outage time for planning purposes, particularly with the dispatch and system operating center functions, DEC also develops an allocation of outage time which incorporates unforeseen schedule delays that may be needed for unplanned equipment repairs found during inspections. The development of each outage allocation is dependent on maintenance and repair activities included in the outage, as well as major projects to be implemented during the outage. Both schedule and allocation are set aggressively to drive continuous improvement in outage planning and execution.

**Q. HOW DOES DEC HANDLE OUTAGE EXTENSIONS AND FORCED OUTAGES?**

A. When an outage extension becomes necessary, DEC expects that work completed in the extension results in longer continuous run times and fewer forced outages, thereby reducing overall fuel costs in the long run. Therefore, if an unanticipated issue that has the potential to become an on-line reliability issue is discovered while a unit is off-line for a scheduled outage and repair cannot be completed within the planned work window, the outage may be extended for the minimum time needed to perform necessary maintenance or repairs prior to returning the unit to service. In

the event that a unit is forced off-line, every effort is made to perform the repair and return the unit to service as quickly as possible.

**Q. DOES DEC PERFORM POST-OUTAGE CRITIQUES AND CAUSE ANALYSES FOR INTERNAL IMPROVEMENT EFFORTS?**

A. Yes. The nuclear industry recognizes that constant focus on operational excellence results in improved nuclear safety and reliability. As such, DEC applies self-critical analysis to each outage to identify every potential cause of an outage delay or event resulting in a forced or extended outage. These critiques evaluate the performance of each function and discipline involved in both outage planning and execution. Lessons learned are applied to drive continuous improvement. These critiques and cause analyses do not document the broader context of the outage or event, and thus rarely reflect strengths and successes.

Q. **WHAT IS THE RELATIONSHIP BETWEEN THE STANDARDS THAT THE COMPANY APPLIES IN ITS POST OUTAGE CRITIQUES AND THE "EVERY REASONABLE EFFORT" STANDARD OF SECTION 58-27-865?**

In our outage evaluations we are looking closely for any opportunity for improvement. We are not assessing the "reasonableness" of any conduct or actions that might have contributed to the outage. Reasonableness focuses on what was done in light of what was known prior to the event; in our outage evaluations we are focused on learning and applying new lessons from our experiences in order to improve our operations.

**Q. WHAT OUTAGES WERE REQUIRED FOR REFUELING AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?**

A. There were four refueling outages during the review period; fall 2017 outages at McGuire Unit 1 and Oconee Unit 2, followed by spring 2018 outages at Catawba Unit 2 and Oconee Unit 3. All four refueling outages were completed within the scheduled allocation.

The McGuire Unit 1 refueling outage began on September 23, 2017 and concluded on October 16, 2017 for duration of 23.5 days compared to a schedule allocation of 26 days. O&M cost for the outage totaled $29.32M compared to a budget of $32.8M. Major component replacements included the 1D reactor coolant pump motor, the 1A1 component cooling motor, the 1A main step-up transformer, the 1A MG Set motor and the 1B reactor coolant drain tank pump. The 1B emergency diesel generator voltage regulator was replaced and the emergency support power supply diesel generator tie in was completed. In addition to major replacements, rebuilds were completed on the 1B1 and 1B2 feedwater oil pumps, the 1G1 and 1G2 heater drain tank pumps, and the 1A1 component cooling pump. Steam Generator work accomplished included 50% u-tube Eddy Current testing and secondary sludge lancing on all four steam generators. Fifty-nine secondary Flow Accelerated Corrosion ("FAC") and 205 In-service Inspections ("ISI") were completed before the unit was returned to service.

On October 27, 2017, Oconee Unit 2 entered a refueling outage lasting 29.82 days compared to a schedule allocation of 32 days. Total O&M outage cost was $28.2M compared to a budget of $30M. In addition to refueling activities, major components, including the 2A1 and 2A2 feedwater heaters, 2A2 reactor coolant pump internal assembly, and power circuit breaker 27 were replaced. The Amertap

condenser tube cleaning system was replaced with an upgraded system improving reliability and efficiency of the condenser. Main power relaying modifications installed new protective relaying for the main and auxiliary transformers and the main generator. Testing and inspection activities included a "rotor out" inspection of the main generator and Steam Generator Eddy Current testing. After refueling, maintenance, testing, and inspections completed, the unit was returned to service on November 26, 2017.

Catawba Unit 2 was removed from the grid on March 17, 2018 for refueling. In addition to refueling activities, safety and reliability enhancements were completed. Major pump and motor work included the replacement of the 2B residual heat removal pump and motor, 2B2 component cooling pump and motor, 2B hotwell pump, and the 2A stator cooling pump. Other pump related work included the 2A condensate booster pump seal and motor replacement, and replacement of the 2A reactor coolant pump seal. Electrical work included modification of the 2A emergency diesel generator ("EDG") governor and the rebuild of the 2B EDG battery charger. Unit 2 emergency supplemental power supply switchgear tie-ins were completed. Rod control cable and connector replacements were completed and the distributed control system was upgraded. After refueling and maintenance activities were successfully completed, the unit returned to service on April 14, 2018. The total outage was completed in 27.9 days compared to a 30 day allocation for an O&M cost of $27.6M verses a budget of $28M. Following the completion of the outage, the unit was briefly removed from the grid (6.2 hours) to complete planned turbine overspeed testing.

Oconee Unit 3 was taken offline on April 20, 2018 to begin refueling. In addition to refueling, general maintenance and safety and reliability enhancements were completed. Eddy Current testing was completed on both steam generators. Twenty-seven tubes were plugged on the 3A steam generator and nine were plugged on the 3B steam generator. Preventive maintenance was completed on the 3C low pressure turbine rotor and the 3A2 high pressure injection line thermal sleeve was replaced. Electrical maintenance included the replacement of 3 high side bushings on the main step-up transformer, and installation of new protective relaying on the main transformer, auxiliary transformer, and the generator. Switchyard Power Circuit Breaker ("PCB") 30 and 102 molded case breakers were replaced. After refueling, testing, and maintenance activities were completed, the Unit returned to service on May 19, 2018. The outage duration was 28.24 days compared to a schedule allocation of 29 days at a total O&M cost of $29.9M compared to an original budget of $28.9M. The O&M overrun was primarily attributable to emergent work activities associated with the repair of the 3C Low Pressure Turbine.

**Q. OTHER THAN REFUELING, WHAT OUTAGES OCCURRED AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?**

There were three short forced outages across the fleet during the review period. Oconee 3 was offline for just over 29 hours in July 2017 due to a main generator lockout, McGuire Unit 1 was offline for 30 hours in February 2018 when the reactor tripped during testing, and Oconee Unit 1 was offline for 39 hours during April 2018 to repair an electrical connector on the Unit's control rod drive system.

**Q. DO YOU BELIEVE ANY OF THE THREE FORCED OUTAGES WERE CAUSED BY A FAILURE BY THE COMPANY TO MAKE REASONABLE EFFORTS TO MINIMIZE FUEL COSTS?**

**A.** No, the three forced ourages were not caused by a failure by the Company to make reasonable efforts to minimize fuel costs. Based on my review of the operations of the McGuire and Oconee units during the review period, I believe that the units were operated reasonable and prudently, and that our operations were conducted in a way that minimized our fuel costs. Plant personnel responded appropriately and as trained during each event, and the units were safely and efficiently returned to service. As stated earlier, the DEC nuclear plants achieved a combined capacity factor of 96.74% during the review period, with four of the seven units completing refueling outages during the period.

**Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?**

A. Yes, it does.

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR CAPACITY FACTOR PURSUANT TO S.C. CODE ANN. § 58-27-865(F)
REVIEW PERIOD OF JUNE 2017 THROUGH MAY 2018

| | | | |
|---|---|---|---|
| 1 | Nuclear System Actual Net Generation During Review Period | 60,845,581 | MWH |
| 2 | Total Number of Hours during Review Period | 8,760 | |
| 3 | Nuclear System MDC during Review Period | 7,180 | MW |
| 4 | Reasonable Nuclear System Reductions | 2,970,500 | MWH |
| 5 | Nuclear System Capacity Factor L1/((L2*L3)-L4)*100 | 101.53 | % |

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE DATA FOR REVIEW PERIOD OF
June 2017 THROUGH MAY 2018

Nuclear outages during the Review Period

| Station/Unit | Date of Outage | Reason for Outage |
|---|---|---|
| Oconee 3 | 7/24/2017 - 7/25/2017 | Forced Maintenance Outage |
| McGuire 1 | 9/23/2017 - 10/16/2017 | Scheduled Refueling - EOC 25 |
| Oconee 2 | 10/27/2017 - 11/26/2017 | Scheduled Refueling - EOC 28 |
| McGuire 1 | 2/16/2018 - 2/17/2018 | Forced Maintenance Outage |
| Catawba 2 | 3/17/2018 - 4/14/2018 | Scheduled Refueling - EOC 22 |
| Catawba 2 | 4/14/2018 - 4/14/2018 [1] | Scheduled Maintenace / Testing |
| Oconee 1 | 4/13/2018 - 4/14/2018 | Forced Maintenance Outage |
| Oconee 3 | 4/20/2018 - 5/19/2018 | Scheduled Refueling - EOC 29 |

[1] Following completion of refueling outage, Unit briefly disconnected from grid to complete turbine overspeed testing

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE SCHEDULE THROUGH BILLING PERIOD

Scheduled nuclear outages lasting one week or more through the Billing Period

| Station/Unit | Date of Outage[1] | Reason for Outage |
|---|---|---|

**REDACTED**

[1] This exhibit represents DEC's current plan, which is subject to change based on fluctuations in operational and maintenance requirements.